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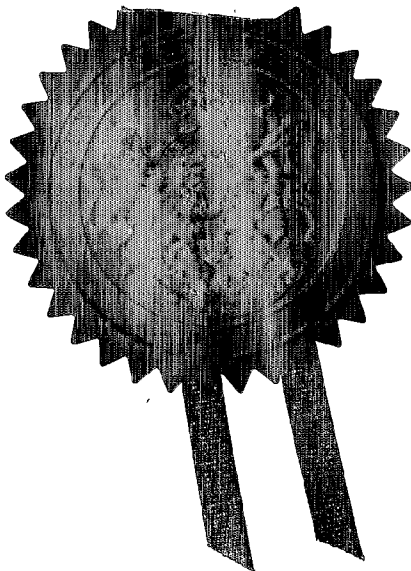
GB04/2329

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

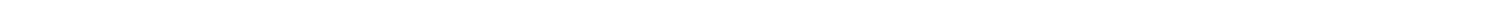
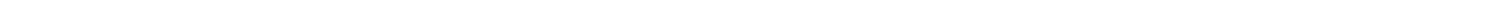
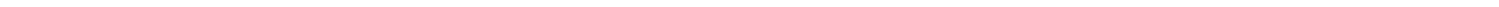
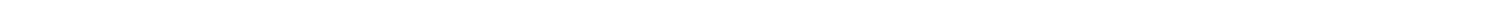
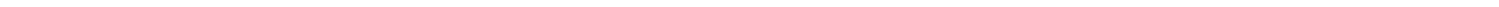
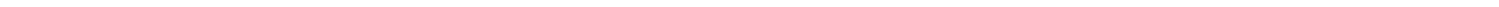
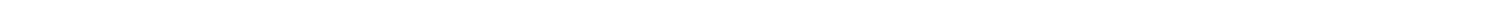
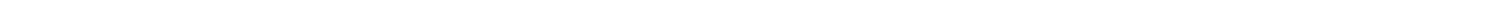
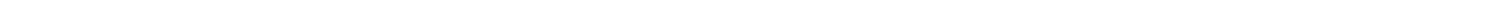
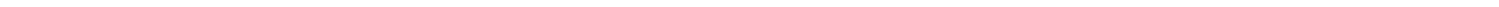
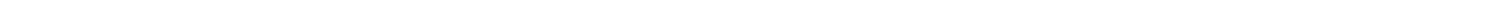
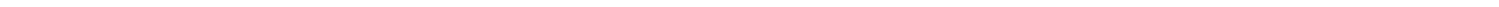
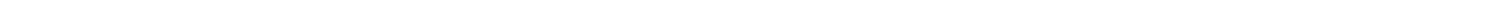
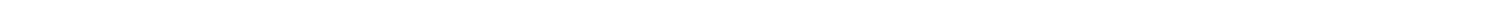
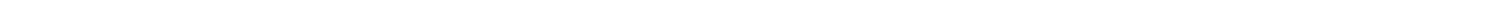
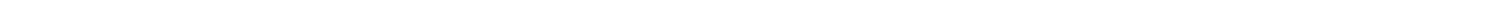
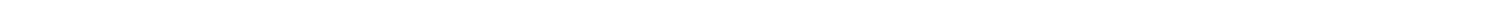
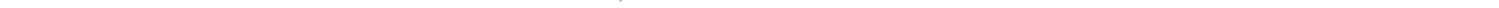
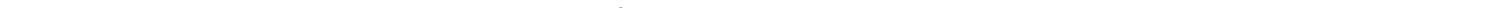
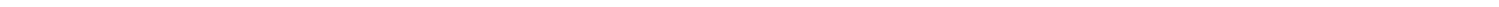
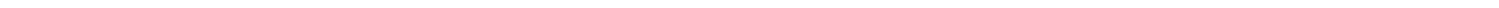
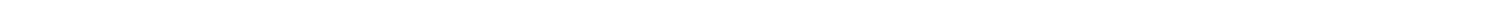
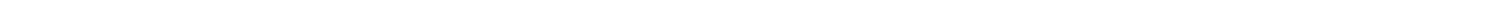
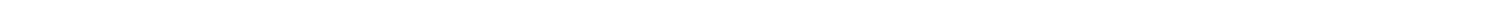
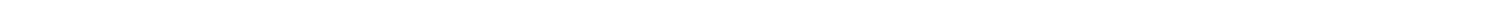
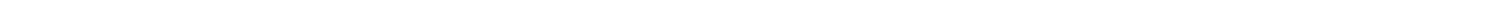
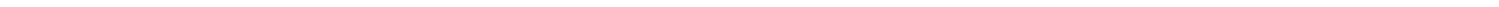
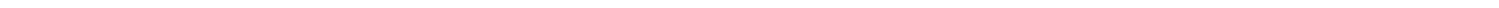
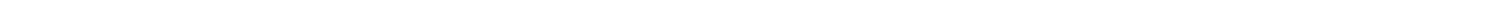
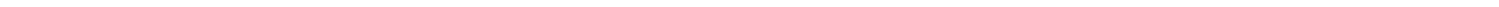
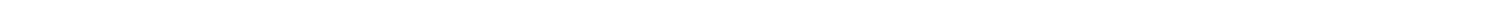
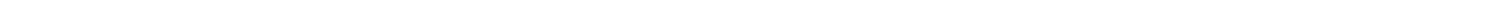
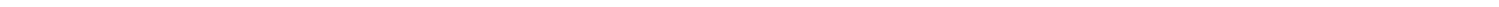
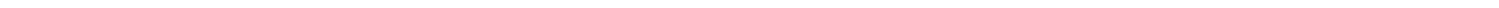
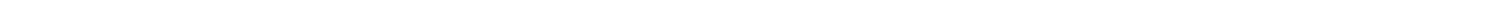
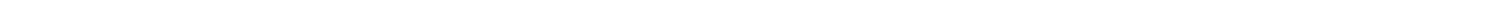
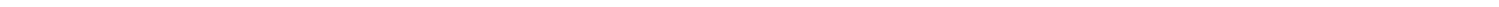
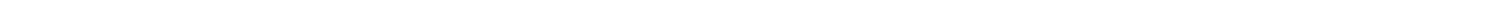
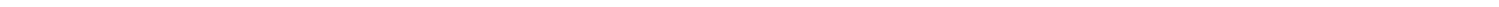
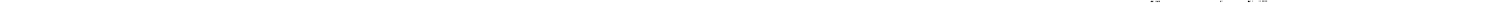
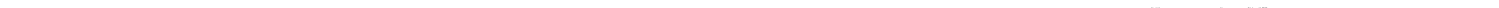
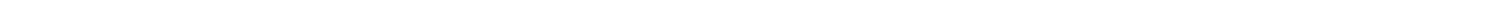
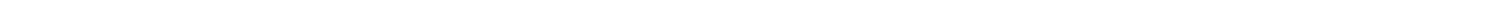
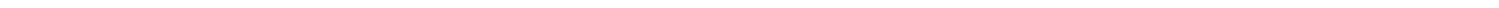
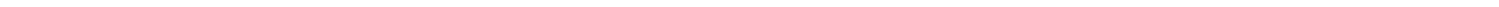
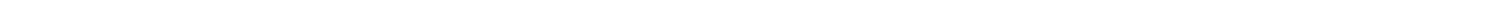
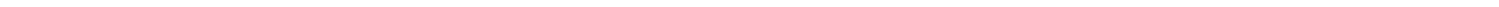
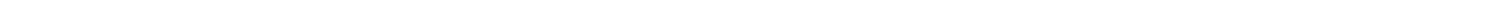
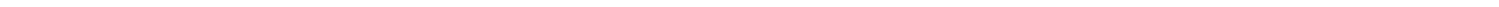
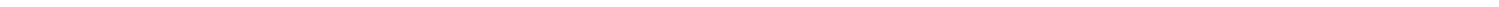
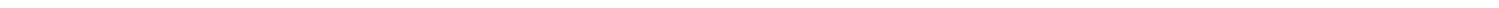
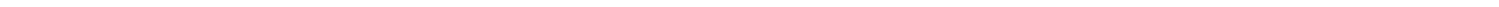
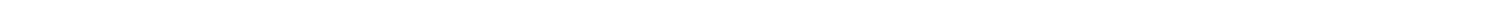
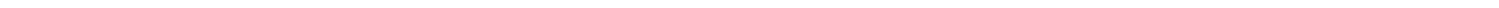
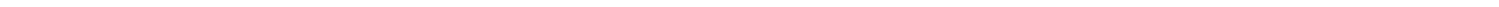
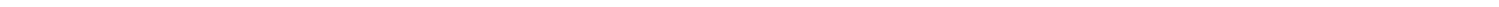
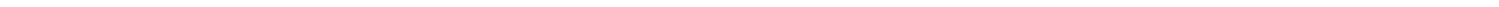
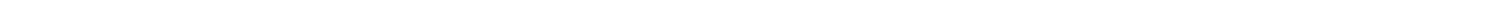
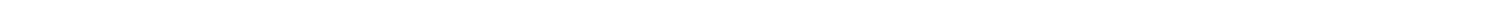
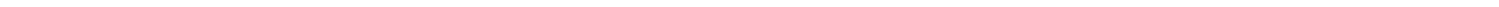
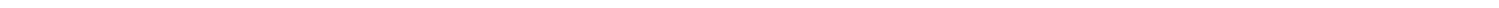
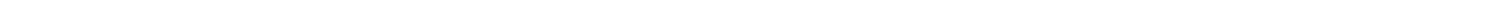
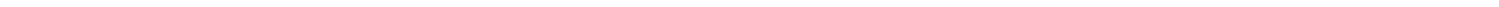
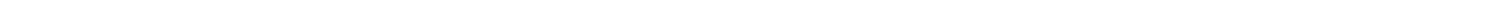
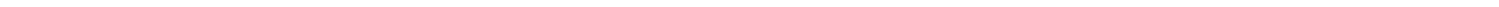
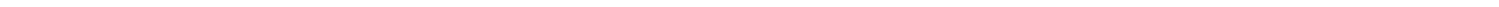
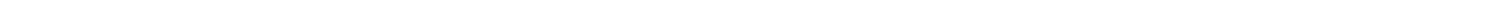
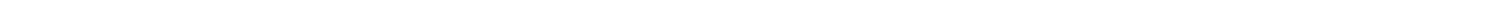
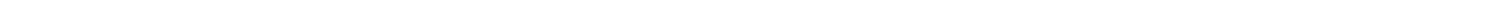
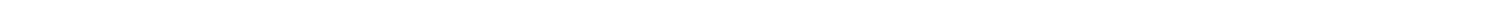
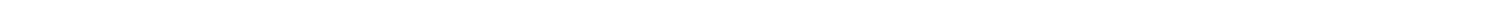
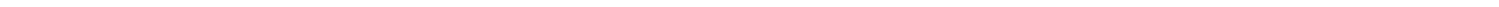
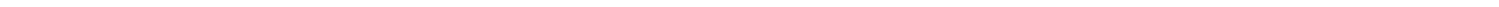
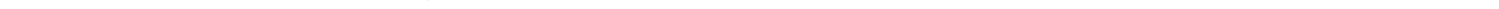
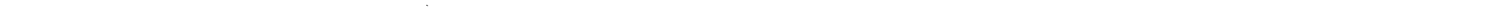
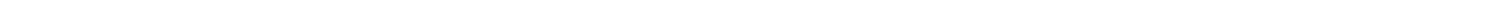
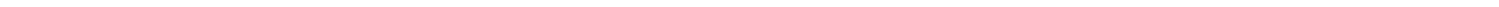
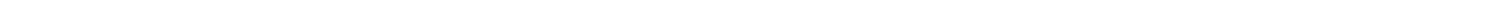
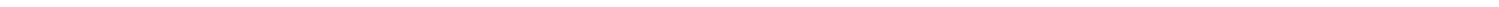
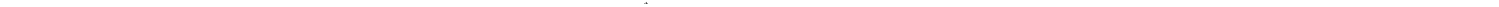
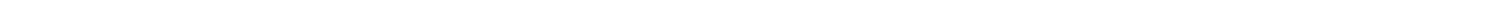
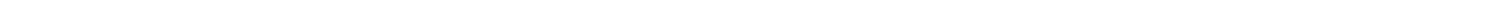
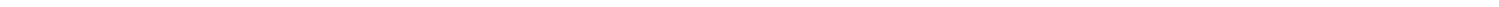
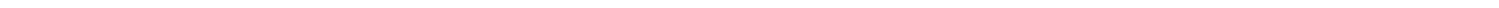
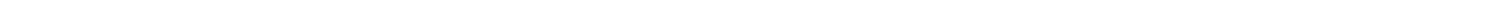
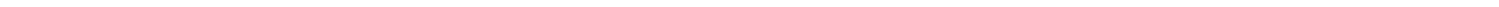
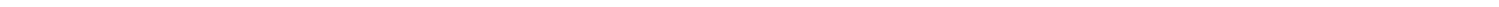
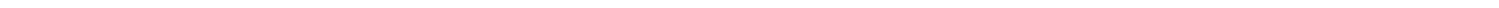
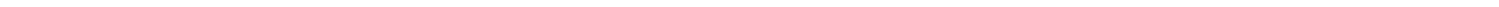
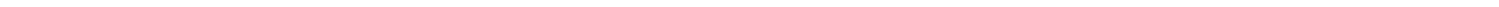
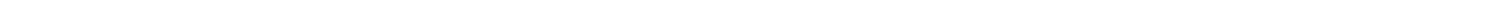
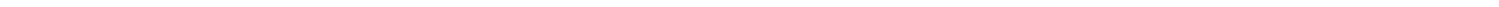
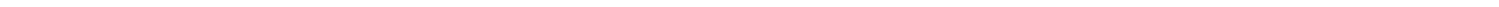
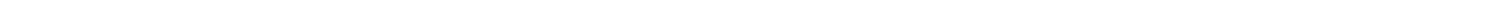
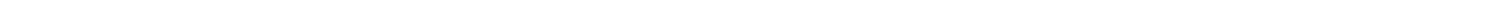
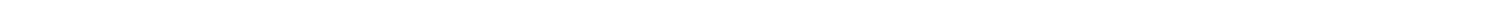
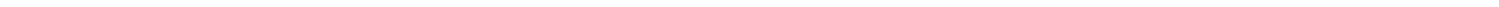
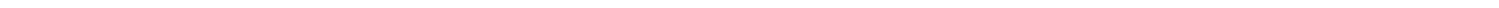
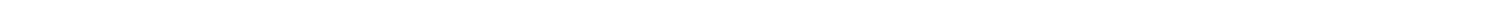
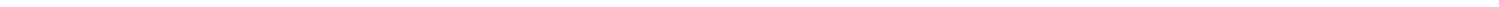
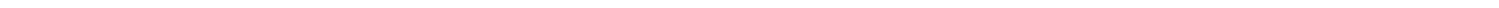
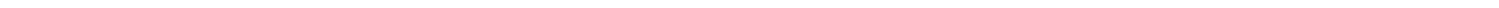
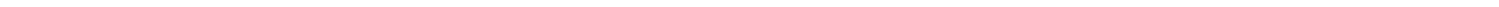
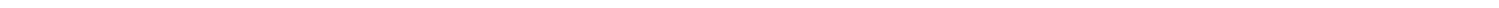
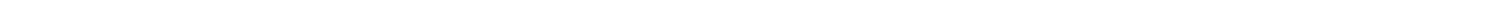
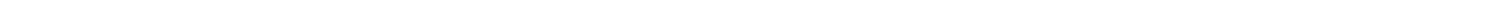
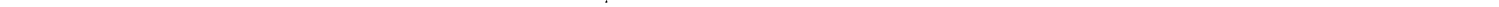
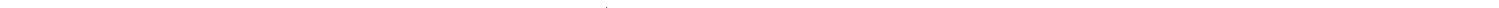
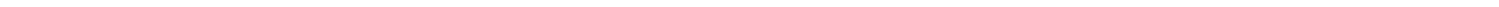
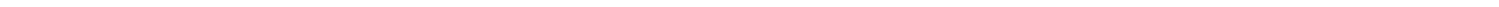
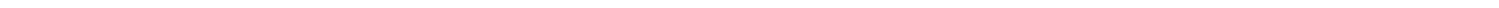
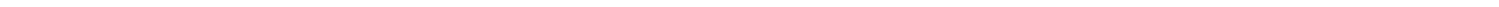
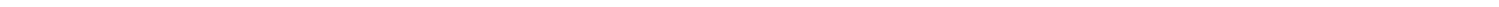
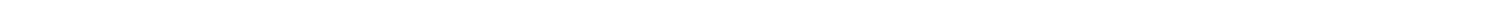
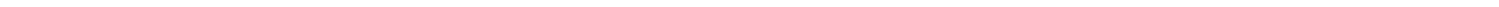
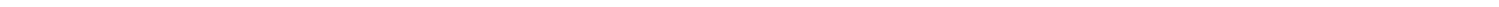
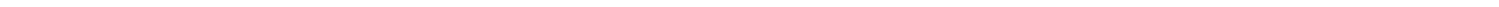
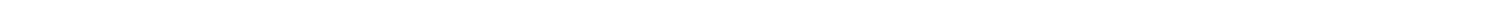
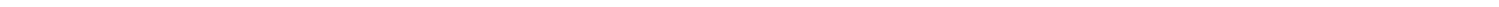
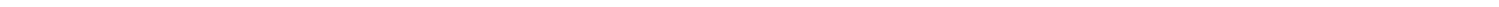
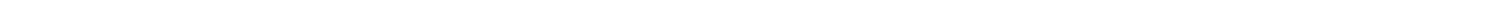
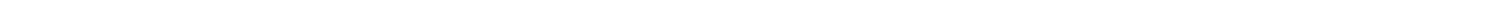
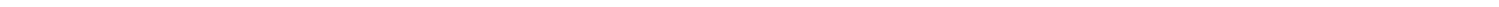
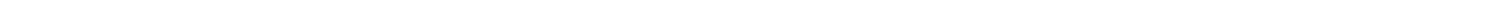
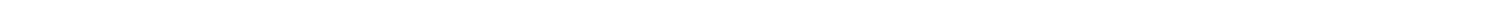
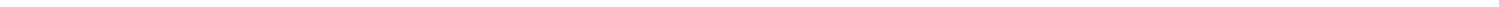
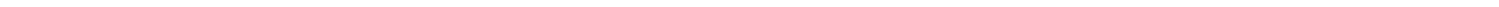
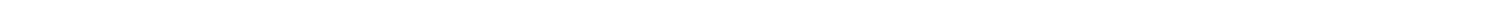
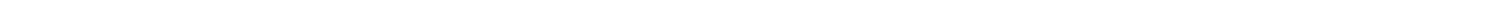
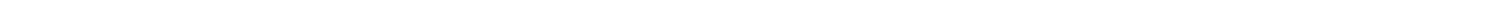
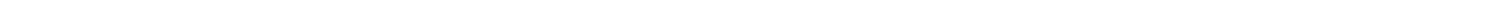
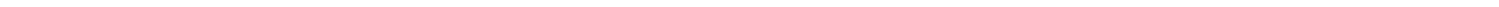
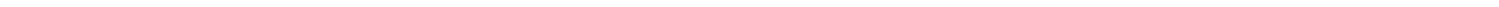
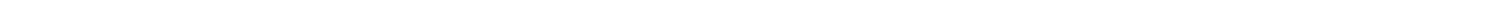
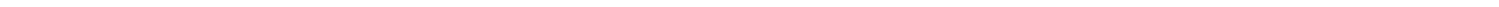
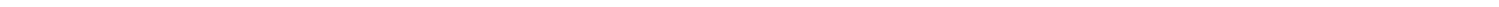
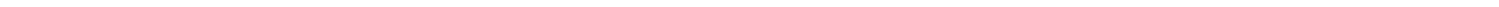
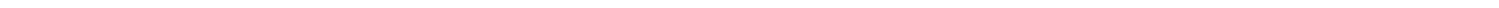
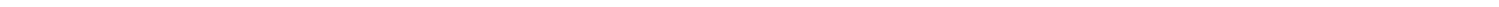
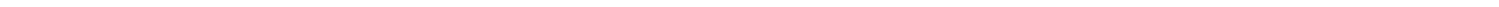
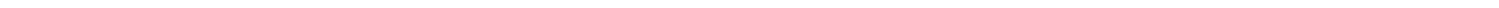
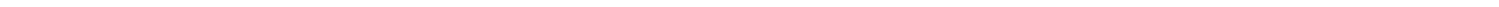
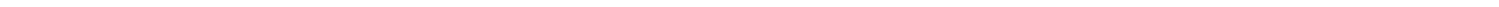
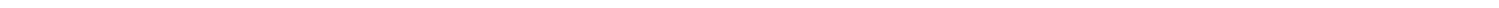
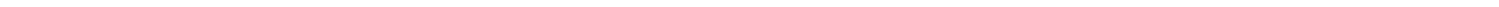
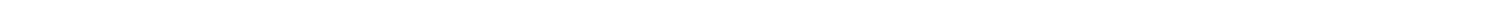
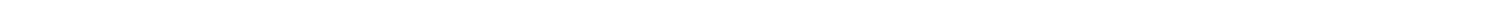
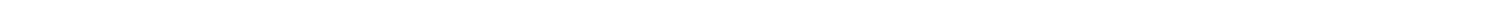
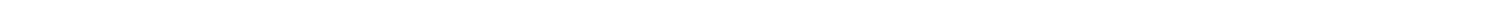
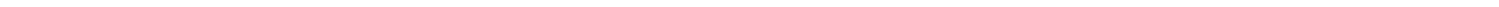
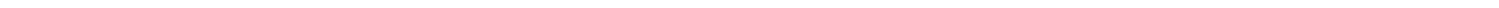
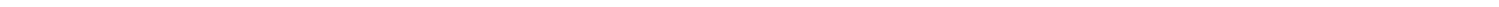
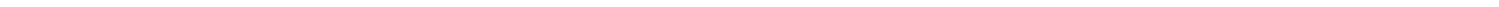
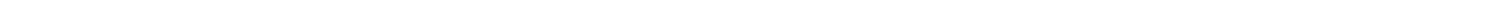
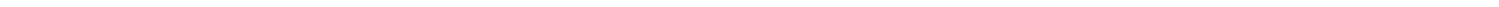
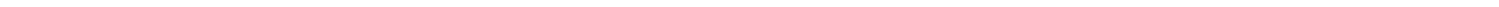
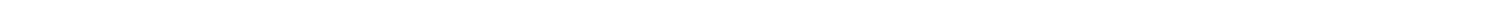
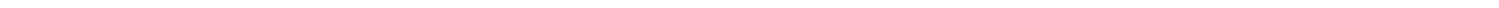
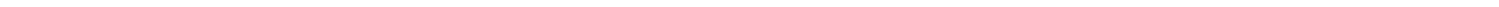
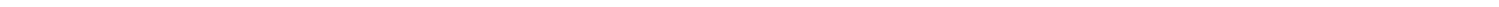
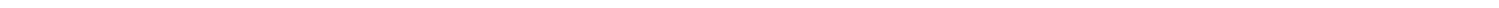
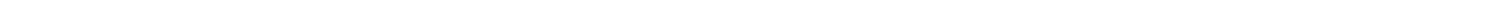
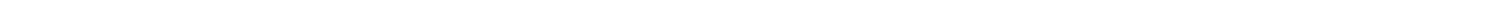
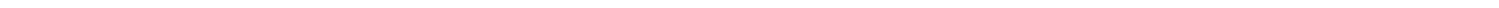
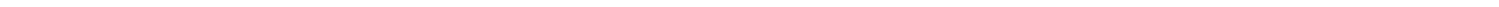
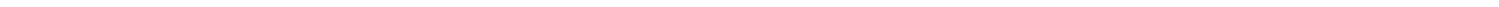
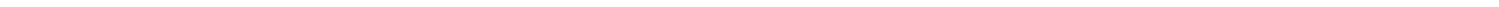
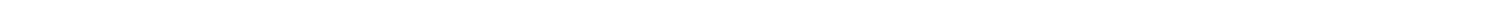
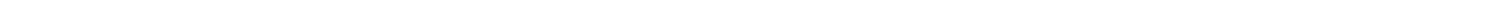
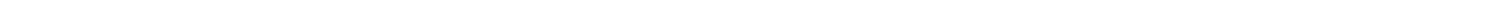
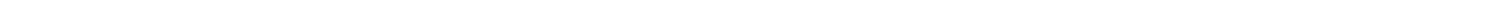
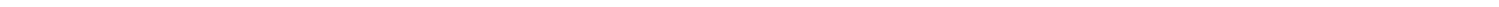
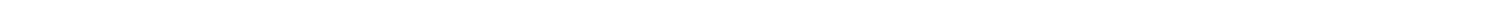
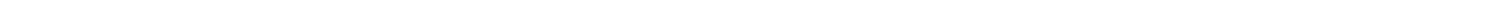
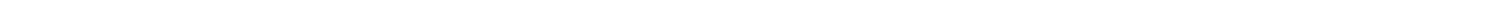
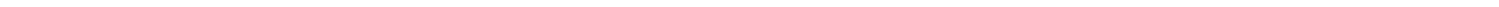
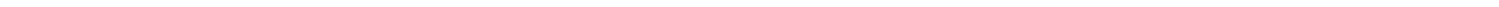
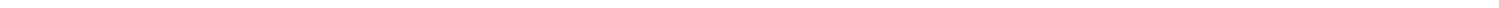
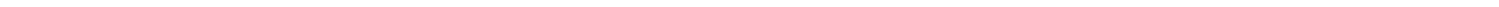
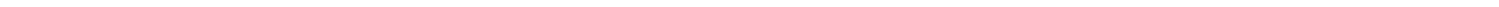
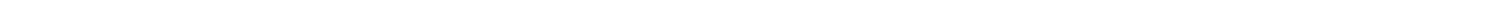
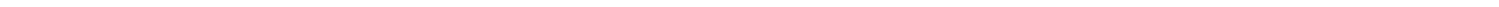
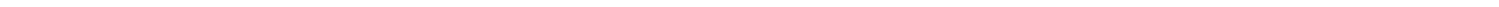
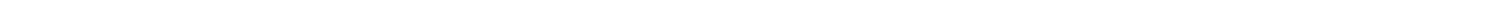
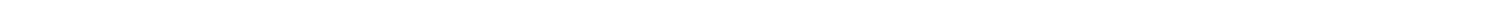
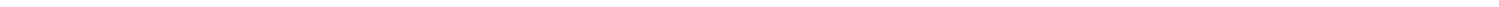
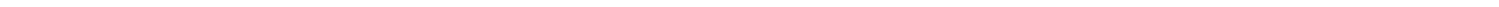
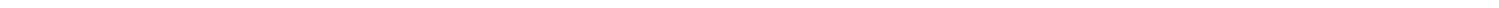
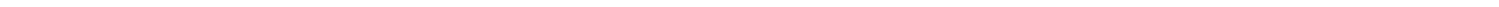
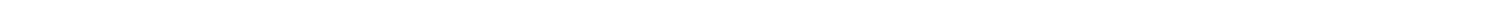
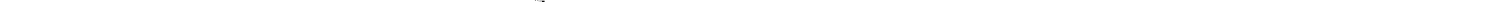
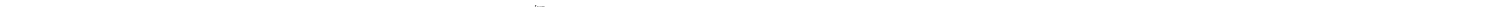
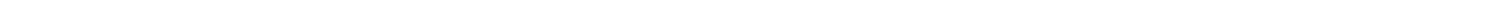
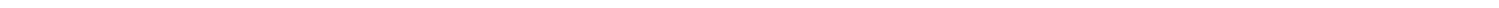
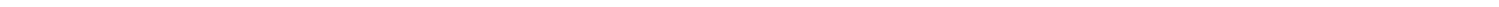
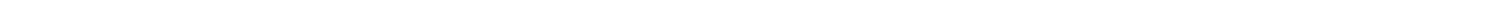
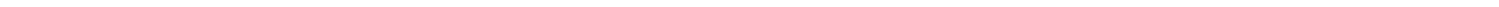
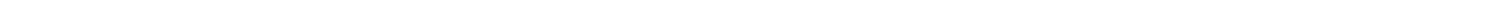
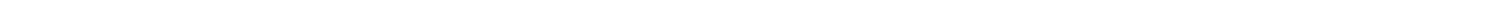
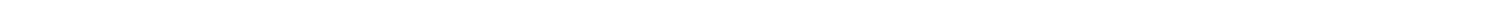
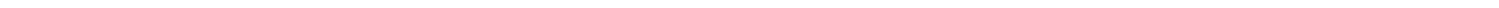
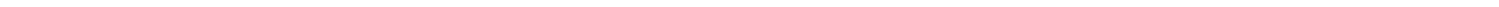
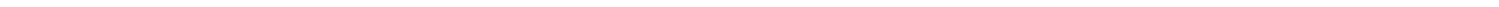
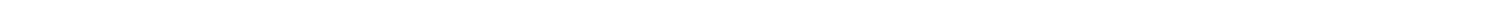
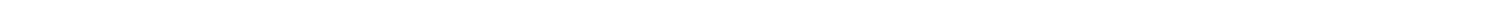
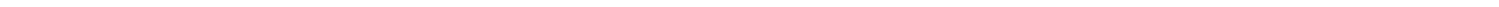
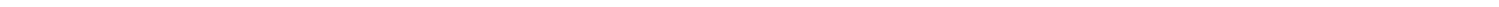
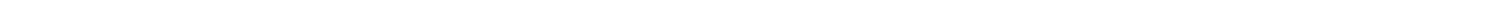
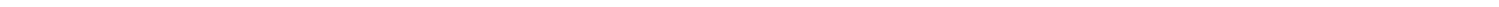
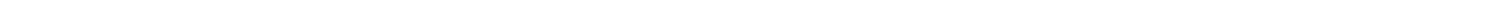
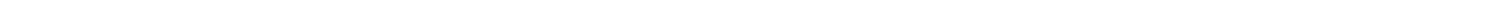
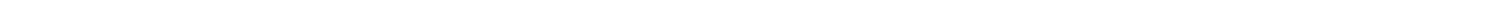
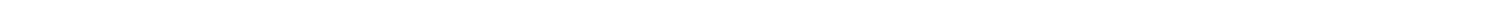
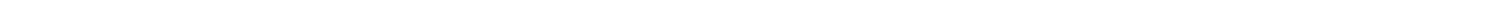
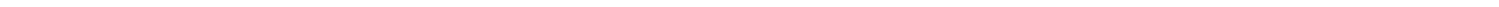
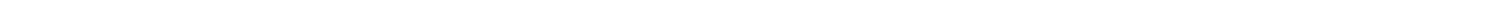
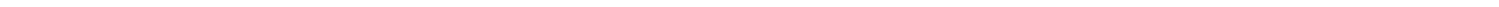
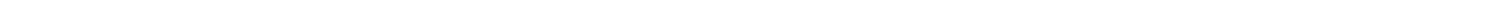
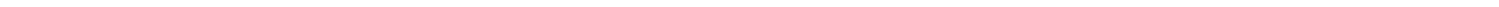
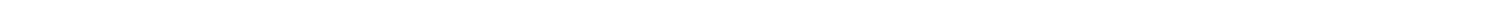
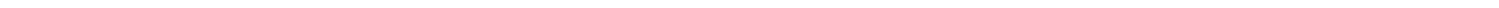
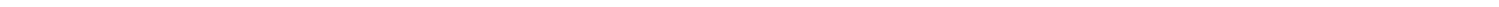
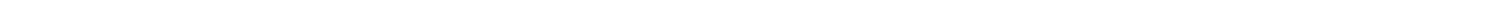
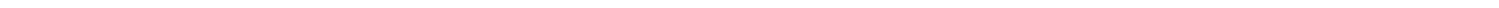
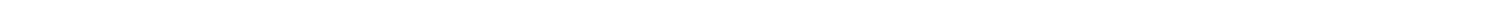
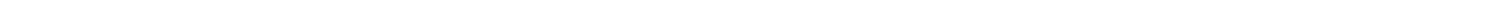
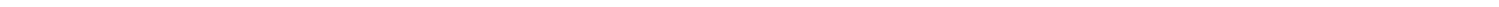
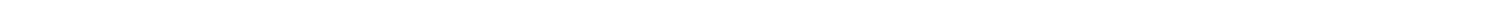
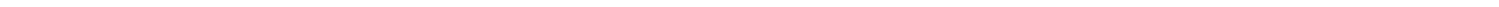
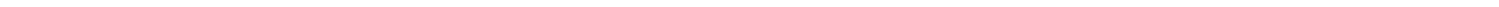
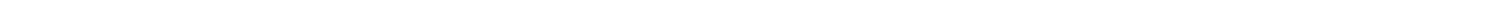
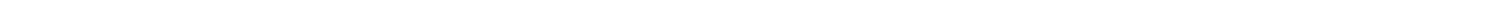
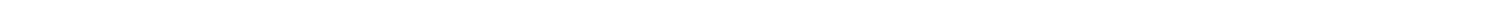
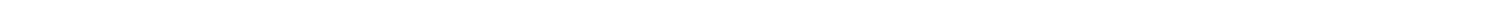
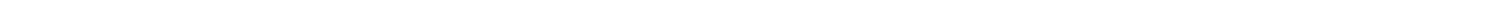
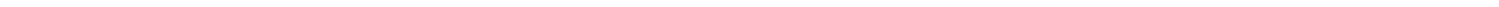
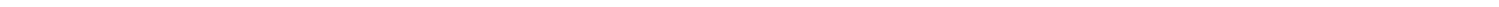
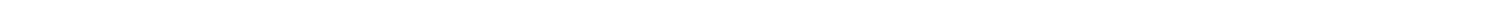
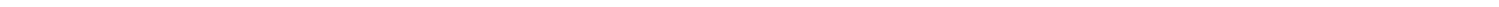
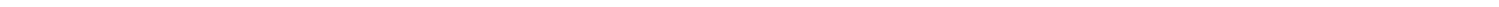
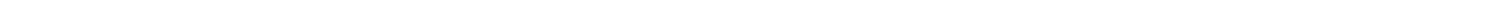
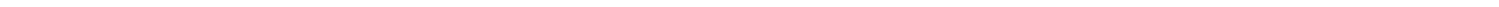
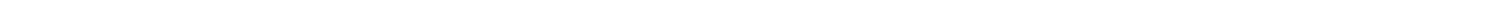
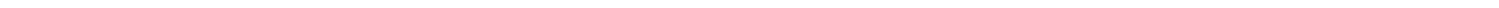
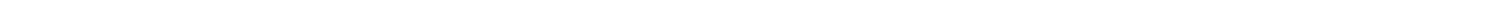
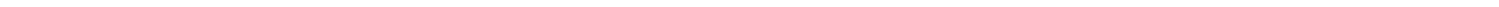
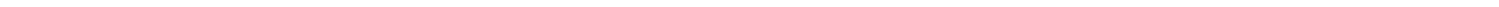
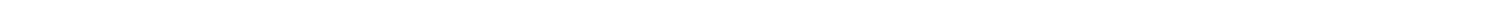
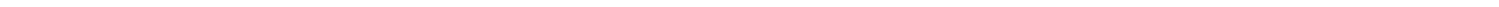
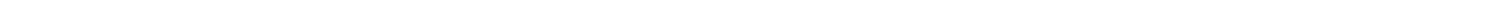
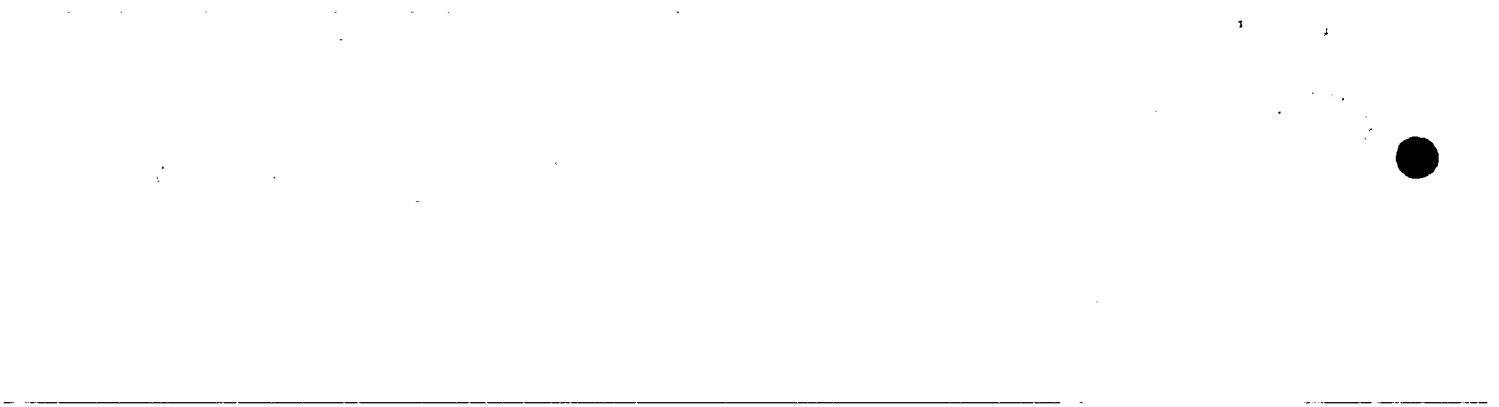
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Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed *Am. Brummer*

Dated 24 June 2004

**PRIORITY
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 SUBMITTED OR TRANSMITTED IN
 COMPLIANCE WITH RULE 17.1(a) OR (b)



Patents Form 1/77

Patents Act 1977
(Rule 16)THE PATENT OFFICE
OF

11 MAR 2004

11MAR04 E880161-1 D02884
P01/7700 0.01-0405471.4 ACCOUNT CMA**Request for grant of a patent**

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

1. Your reference

P367651/JED/DBR/JAL

2. Patent application number

(The Patent Office will fill this part in)

0405471.4

11 MAR 2004

3. Full name, address and postcode of the or of each applicant (underline all surnames)

DES Enhanced Recovery Limited
Westhill Business Centre
Amhall Business Park
Westhill, Aberdeen, AB32 8US

Patents ADP number (if you know it)

8642258001

If the applicant is a corporate body, give the country/state of its incorporation

United Kingdom

4. Title of the invention

"Apparatus and Method for Recovering Fluids From A Well"

5. Name of your agent (if you have one)

Murgitroyd & Company

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

165-169 Scotland Street
Glasgow
G5 8PL

Patents ADP number (if you know it)

1198013/S

6. Priority: Complete this section if you are declaring priority from one or more earlier patent applications, filed in the last 12 months.

Country

Priority application number
(if you know it)Date of filing
(day / month / year)

United Kingdom

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

Number of earlier UK application

Date of filing
(day / month / year)

8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request?

Yes

Answer YES if:

- a) any applicant named in part 3 is not an inventor, or
 - b) there is an inventor who is not named as an applicant, or
 - c) any named applicant is a corporate body.
- Otherwise answer NO (See note d)

Patents Form 1/77

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Patents Form 1/77

9. Accompanying documents: A patent application must include a description of the invention. Not counting duplicates, please enter the number of pages of each item accompanying this form:

Continuation sheets of this form -

Description - 20

Claim(s) -

Abstract -

Drawing(s) 3 only

10. If you are also filing any of the following, state how many against each item.

Priority documents -

Translations of priority documents -

Statement of inventorship and right to grant of a patent (Patents Form 7/77) -

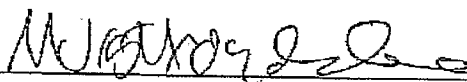
Request for a preliminary examination and search (Patents Form 9/77) -

Request for a substantive examination (Patents Form 10/77) -

Any other documents (please specify) -

11. I/We request the grant of a patent on the basis of this application.

Signature(s)



Date 11/03/04

12. Name, daytime telephone number and e-mail address, if any, of person to contact in the United Kingdom

Jamie Allan
01224 706616**Warning**

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

- If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.
- Write your answers in capital letters using black ink or you may type them.
- If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
- If you have answered YES in part 8, a Patents Form 7/77 will need to be filed.
- Once you have filled in the form you must remember to sign and date it.
- Part 7 should only be completed when a divisional application is being made under section 15(4), or when an application is being made under section 8(3), 12(6) or 37(4) following an entitlement dispute. By completing part 7 you are requesting that this application takes the same filing date as an earlier UK application. If you want the new application to have the same priority date(s) as the earlier UK application, you should also complete part 6 with the priority details.

1 Apparatus and Method for recovering fluids from a
2 well

3
4 The present invention relates to an apparatus and
5 method for diverting fluids.

6
7 It is common for a subsea well to have a christmas
8 tree on the seabed and for this christmas tree to
9 have a choke located in the production wing branch.
10 Production fluids flow up the production bore, into
11 the production wing branch, through the choke, and
12 out of an outlet of the production wing branch into
13 an outlet header, from where the fluids are conveyed
14 away, for example, to the surface. Wells and trees
15 are often active for a long time, and so wells from
16 a decade ago may still be in use today. However,
17 technology has progressed a great deal during this
18 time, for example, subsea processing of fluids is
19 now desirable. Such processing can involve adding
20 chemicals, separating water and sand from the
21 hydrocarbons, etc. Furthermore, it is sometimes
22 desired to take fluids from one well and inject a

1 component of these fluids into another well. To do
2 any of these things involves breaking the pipework
3 attached to the outlet of the wing branch, inserting
4 new pipework leading to this processing equipment,
5 alternative well, etc. This provides the problem
6 and large associated risks of disconnecting pipe
7 work which has been in place for a considerable
8 time, and which was never intended to be
9 disconnected. Furthermore, due to environmental
10 regulations, no produced fluids are allowed to leak
11 out into the ocean, and any such unanticipated and
12 unconventional disconnection provides the risk that
13 this will occur.

14
15 According to a first aspect of the present invention
16 there is provided a diverter assembly for a
17 christmas tree, comprising a housing having an
18 internal passage, wherein the diverter assembly is
19 adapted to be attached to a choke body so that the
20 internal passage of the diverter assembly is in
21 communication with the interior of the choke body.

22
23 The invention provides the advantage that fluids can
24 be diverted from their usual path between the well
25 bore and the outlet of the wing branch. The fluids
26 may be produced fluids being recovered and
27 travelling from the well bore to the outlet.
28 Alternatively, the fluids may be injection fluids
29 travelling in the reverse direction into the well
30 bore. As the choke is standard equipment, there are
31 well-known and safe techniques of removing and
32 replacing the choke as it wears out. The same tried

1 and tested techniques can be used to remove the
2 choke from the choke body and to clamp the diverter
3 assembly onto the choke body, without the risk of
4 leaking well fluids into the ocean. This enables
5 new pipe work to be connected to the choke body and
6 hence enables safe re-routing of the produced
7 fluids, without having to undertake the considerable
8 risk of disconnecting and reconnecting any of the
9 existing pipes (e.g. the outlet header).

10
11 Some embodiments allow fluid communication between
12 the well bore and the diverter assembly. Other
13 embodiments allow the well bore to be separated from
14 a region of the diverter assembly. The choke body
15 may be a production choke body or an annulus choke
16 body. The well bore may be a production bore or an
17 annulus bore.

18
19 Preferably, a first end of the diverter assembly is
20 provided with a clamp for attachment to a choke
21 body.

22
23 Optionally, the housing is cylindrical and the
24 internal passage extends axially through the housing
25 between opposite ends of the housing.
26 Alternatively, one end of the internal passage is in
27 a side of the housing.

28
29 Typically, the flow diverter assembly includes
30 separation means to provide two separate regions
31 within the flow diverter assembly. Typically, each
32 of these regions has a respective inlet and outlet

1 so that fluid can flow through both of these regions
2 independently.

3

4 Optionally, the housing includes an axial insert
5 portion.

6

7 Typically, the axial insert portion is in the form
8 of a conduit. Typically, the end of the conduit
9 extends beyond the end of the housing. Preferably,
10 the conduit divides the inside of the diverter
11 assembly into a first region formed by the bore of
12 the conduit and a second region formed by the
13 annulus between the housing and the conduit.

14 Optionally, the conduit is adapted to seal within
15 the inside of a choke body to prevent fluid
16 communication between the annulus and the bore of
17 the conduit.

18

19 Alternatively, the axial insert portion is in the
20 form of a stem. Optionally, the axial insert
21 portion is provided with a plug adapted to block an
22 outlet of the christmas tree. Preferably, the plug
23 is adapted to fit within and seal inside a passage
24 leading to an outlet of a branch of the christmas
25 tree.

26

27 Optionally, the diverter assembly provides means for
28 diverting fluids from a first portion of a first
29 flowpath to a second flowpath, and means for
30 diverting the fluids from a second flowpath to a
31 second portion of a first flowpath.

32

1 According to a second aspect of the present
2 invention there is provided a christmas tree having
3 a choke body and a diverter assembly; wherein the
4 diverter assembly comprises a housing having an
5 internal passage, and wherein the diverter assembly
6 is attached to the choke body so that the internal
7 passage of the diverter assembly is in communication
8 with the interior of the choke body.

9
10 The choke body may be a production choke body or an
11 annulus choke body. The well bore may be a
12 production bore or an annulus bore.

13
14 Optionally, the diverter assembly is attached to the
15 choke body by a clamp.

16
17 Optionally, the christmas tree has a wing branch and
18 a wing branch outlet, and the internal passage of
19 the diverter assembly is in fluid communication with
20 the wing branch outlet. Optionally, a region
21 defined by the diverter assembly is separate from
22 the production bore of the well. Optionally, the
23 internal passage of the diverter assembly is
24 separated from the well bore by a closed valve in
25 the christmas tree.

26
27 Alternatively, the diverter assembly is provided
28 with an insert in the form of a conduit which
29 defines a first region comprising the bore of the
30 conduit, and a second separate region comprising the
31 annulus between the conduit and the housing.
32 Optionally, one end of the conduit is sealed inside

1 the choke body to prevent fluid communication
2 between the first and second regions.

3

4 Optionally, the annulus between the conduit and the
5 housing is closed so that the annulus is in
6 communication with the wing branch only.

7

8 Alternatively, the annulus has an outlet for
9 connection to further pipes, so that the second
10 region provides a flowpath which is separate from
11 the first region formed by the bore of the conduit.

12

13 Optionally, the first and second regions are
14 connected by pipework. Optionally, a processing
15 apparatus is connected in the pipework so that
16 fluids are processed whilst passing through the
17 connecting pipework.

18

19 Typically, the processing apparatus is selected from
20 at least one of the group consisting of:
21 a pump; a process fluid turbine; injection apparatus
22 for injecting gas or steam; chemical injection
23 apparatus; a fluid riser; measurement apparatus;
24 temperature measurement apparatus; flow rate
25 measurement apparatus; constitution measurement
26 apparatus; consistency measurement apparatus; gas
27 separation apparatus; water separation apparatus;
28 solids separation apparatus; and hydrocarbon
29 separation apparatus.

30

31 Optionally, the diverter assembly provides a barrier
32 to separate the wing branch outlet from the wing

1 branch. Optionally, the barrier comprises a plug,
2 which is typically located inside the choke body to
3 block the wing branch outlet. Optionally, the plug
4 is attached to the housing by a stem which extends
5 axially through the internal passage of the housing.

6
7 Alternatively, the barrier comprises a conduit of
8 the diverter assembly which is engaged within the
9 choke body.

10
11 Optionally, the christmas tree is provided with a
12 conduit connecting the first and second regions.

13
14 According to a third aspect of the present
15 invention, there is provided a method of diverting
16 fluids, comprising: attaching a diverter assembly to
17 a choke body of a christmas tree, wherein the
18 diverter assembly comprises a housing having an
19 internal passage, so that the internal passage of
20 the diverter assembly is in communication with the
21 interior of the choke body; and diverting the fluids
22 through the housing.

23
24 Optionally, the christmas tree includes a wing
25 branch and a wing branch outlet and the diverter
26 assembly provides a barrier which separates the wing
27 branch outlet from the rest of the wing branch.

28
29 Optionally, the method is used to recover produced
30 fluids from a well by diverting produced fluids from
31 the production bore, through the internal passage in

1 the diverter assembly to an aperture in the diverter
2 assembly.

3

4 Alternatively, the method is used to inject fluids
5 into a well, by delivering fluids through an
6 aperture in the diverter assembly, through the
7 internal passage and the choke body, and into the
8 well.

9

10 Alternatively, the method is used to divert fluids
11 between the wing branch outlet and the aperture of
12 the diverter assembly. The fluids may be passed in
13 either direction through the diverter assembly, so
14 that the aperture of the diverter assembly comprises
15 an inlet or an outlet.

16

17 Typically, the flow diverter assembly includes
18 separation means to provide two separate flow
19 regions within the flow diverter assembly, and the
20 method includes the step of passing fluids through
21 both of these regions.

22

23 Typically, the housing of the diverter assembly has
24 an extension portion in the form of an interior
25 conduit extending internally through the housing,
26 the bore of the conduit defining a first flow
27 region, and the annulus between the conduit and the
28 housing defining a second flow region, each of the
29 first and the second flow regions having a
30 respective inlet and outlet, and the method includes
31 the step of passing fluids through both of the first
32 and the second flow regions.

1
2 Optionally, fluids are passed through the first and
3 the second flow regions in the same direction.
4 Alternatively, fluids are passed through the first
5 and the second flow regions in opposite directions.
6
7 Optionally, the fluids are passed through one of the
8 first and second flow regions and subsequently at
9 least a proportion of these fluids are then passed
10 through the other of the first and the second flow
11 regions. Optionally, the method includes the step
12 of processing the fluids in a processing apparatus
13 before passing the fluids back to the other of the
14 first and second regions.
15
16 Optionally, the first and second regions are
17 connected by pipework. Optionally, a processing
18 apparatus is connected in the pipework so that
19 fluids are processed whilst passing through the
20 connecting pipework.
21
22 Typically, the processing apparatus is selected from
23 at least one of the group consisting of:
24 a pump; a process fluid turbine; injection apparatus
25 for injecting gas or steam; chemical injection
26 apparatus; a fluid riser; measurement apparatus;
27 temperature measurement apparatus; flow rate
28 measurement apparatus; constitution measurement
29 apparatus; consistency measurement apparatus; gas
30 separation apparatus; water separation apparatus;
31 solids separation apparatus; and hydrocarbon
32 separation apparatus.

1
2 Typically, the method includes the step of removing
3 a choke from the choke body before attaching the
4 diverter assembly to the choke body.
5
6 Optionally, the method includes the step of
7 diverting fluids from a first portion of a first
8 flowpath to a second flowpath and diverting the
9 fluids from the second flowpath to a second portion
10 of the first flowpath.
11
12 The method provides the advantage that fluids can be
13 diverted (e.g. recovered or injected into the well,
14 or even diverted from another route, bypassing the
15 well completely) without having to remove and
16 replace any pipes already attached to the wing
17 branch outlet.
18
19 According to a fourth aspect of the invention there
20 is provided a flow diverter assembly comprising a
21 conduit adapted to be inserted within a christmas
22 tree branch bore, such that the bore of the conduit
23 defines a first region and the annulus between the
24 conduit and the christmas tree branch bore defines a
25 second region.
26
27 Preferably, each of the first and the second region
28 has a respective inlet and outlet, so fluids can
29 flow through both of these regions.
30

11

1 An embodiment of the invention will now be
2 described, by way of example only, and with
3 reference to the following drawings, in which:-

4
5 Fig 1 shows a cross-sectional view of a first
6 embodiment of a diverter assembly;

7
8 Fig 2 shows a cross-sectional view of a second
9 embodiment of a diverter assembly;

10
11 Fig 3 shows a cross-sectional view of a third
12 embodiment of a diverter assembly; and

13
14 Fig 4 shows a cross-sectional view of a fourth
15 embodiment of a diverter assembly.

16
17 Fig 1 shows a diverter assembly 10 which is attached
18 to a choke body 12, which is located in the
19 production wing branch 14 of a christmas tree 16.
20 The production wing branch 14 has an outlet 18,
21 which is located adjacent to the choke body 12. The
22 diverter assembly 10 is attached to the choke body
23 12 by a clamp 19. A first valve V1 is located in
24 the central bore of the christmas tree and a second
25 valve V2 is located in the production wing branch
26 14.

27
28 The choke body 12 is a standard subsea choke body
29 from which the original choke has been removed. The
30 choke body 12 has a bore which is in fluid
31 communication with the production wing branch 14.
32 The upper end of the bore of the choke body 12

12

1 terminates in an aperture in the upper surface of
2 the choke body 12. The lower end of the bore of the
3 choke body communicates with the bore of the
4 production wing branch 14 and the outlet 18.

5
6 The diverter assembly 10 has a cylindrical housing
7 20, which has an interior axial passage 22. The
8 lower end of the axial passage 22 is open; i.e. it
9 terminates in an aperture. The upper end of the
10 axial passage 22 is closed, and a lateral passage 26
11 extends from the upper end of the axial passage 22
12 to an outlet 24 in the side wall of the cylindrical
13 housing 20.

14
15 The diverter assembly 10 has a stem 28 which extends
16 from the upper closed end of the axial passage 22,
17 down through the axial passage 22, where it
18 terminates in a plug 30. The stem 28 is longer than
19 the housing 20, so the lower end of the stem 28
20 extends beyond the lower end of the housing 20. The
21 plug 30 is shaped to engage a seat in the choke body
22 12, so that it blocks the part of the production
23 wing branch 14 leading to the outlet 18. The plug
24 therefore prevents fluids from the production wing
25 branch 14 or from the choke body 12 from exiting via
26 the outlet 18. The plug is optionally provided with
27 a seal, to ensure that no leaking of fluids can take
28 place.

29
30 Before fitting the diverter assembly 10 to the tree
31 16, a choke is typically present inside the choke
32 body 12 and the outlet 18 is typically connected to

13

1 an outlet conduit, which conveys the produced fluids
2 away e.g. to the surface. Produced fluids flow
3 through the bore of the christmas tree 16, through
4 valves V1 and V2, through the production wing branch
5 14, and out of outlet 18 via the choke.

6
7 The diverter assembly 10 can be retrofitted to a
8 well by closing one or both of the valves V1 and V2
9 of the christmas tree 16. This prevents any fluids
10 leaking into the ocean whilst the diverter assembly
11 10 is being fitted. The choke (if present) is
12 removed from the choke body 12 by a standard removal
13 procedure known in the art. The diverter assembly
14 10 is then clamped onto the top of the choke body 12
15 by the clamp 19 so that the stem 28 extends into the
16 bore of the choke body 12 and the plug 30 engages a
17 seat in the choke body 12 to block off the outlet
18 18. Further pipework (not shown) is then attached
19 to the outlet 24 of the diverter assembly 10. This
20 further pipework can now be used to divert the
21 fluids to any desired location. For example, the
22 fluids may be then diverted to a processing
23 apparatus, or a component of the produced fluids may
24 be diverted into another well bore to be used as
25 injection fluids. Further examples of processing
26 apparatus are described in more detail below.

27

28 The valves V1 and V2 are now re-opened which allows
29 the produced fluids to pass into the production wing
30 branch 14 and into the choke body 12, from where
31 they are diverted from their former route to the
32 outlet 18 by the plug 30, and are instead diverted

14

1 through the diverter assembly 10, out of the outlet
2 24 and into the pipework attached to the outlet 24.

3
4 Although the above has been described with reference
5 to recovering produced fluids from a well, the same
6 apparatus could equally be used to inject fluids
7 into a well, simply by reversing the flow of the
8 fluids. Injected fluids could enter the diverter
9 assembly 10 at the aperture 24, pass through the
10 diverter assembly 10, the production wing branch 14
11 and into the well. Although this example has
12 described a production wing branch 14 which is
13 connected to the production bore of a well, the
14 diverter assembly 10 could equally be attached to an
15 annulus choke body connected to an annulus wing
16 branch and an annulus bore of the well, and used to
17 divert fluids flowing into or out from the annulus
18 bore.

19
20 Fig 2 shows an alternative embodiment of a diverter
21 assembly 10' attached to the christmas tree 16, and
22 like parts will be designated by like numbers having
23 a prime. The christmas tree 16 is the same
24 christmas tree 16 as shown in Fig 1, so these
25 reference numbers are not primed.

26
27 The housing 20' in the diverter assembly 10' is
28 cylindrical with an axial passage 22'. However, in
29 this embodiment, there is no lateral passage, and
30 the upper end of the axial passage 22' terminates in
31 an aperture 30' in the upper end of the housing 20',
32 so that the upper end of the housing 20' is open.

15

1 Thus, the axial passage 22' extends all of the way
2 through the housing 20' between its lower and upper
3 ends. The aperture 30' can be connected to external
4 pipework (not shown).

5
6 Fig 3 shows a further alternative embodiment of a
7 diverter assembly 10'', and like parts are
8 designated by like numbers having a double prime.
9 This figure is cut off after the valve V2; the rest
10 of the christmas tree is the same as that of the
11 previous two embodiments. Again, the christmas tree
12 of this embodiment is the same as those of the
13 previous two embodiments, and so these reference
14 numbers are not primed.

15
16 The housing 20'' of the Fig 3 embodiment is
17 substantially the same as the housing 20' of the Fig
18 2 embodiment. The housing 20'' is cylindrical and
19 has an axial passage 22'' extending therethrough
20 between its lower and upper ends, both of which are
21 open. The aperture 30'' can be connected to
22 external pipework (not shown).

23
24 The housing 20'' is provided with an extension
25 portion in the form of a conduit 32'', which extends
26 from near the upper end of the housing 20'', down
27 through the axial passage 22'' to a point beyond the
28 end of the housing 20''. The conduit 32'' is
29 therefore internal to the housing 20'', and defines
30 an annulus 34'' between the conduit 32'' and the
31 housing 20''.

32

16

1 The lower end of the conduit 32'' is adapted to fit
2 inside a recess in the choke body 12, and is
3 provided with a seal 36, so that it can seal within
4 this recess, and the length of conduit 32'' is
5 determined accordingly.

6
7 As shown in Fig 3, the conduit 32'' divides the
8 space within the choke body 12 and the diverter
9 assembly 10'' into two distinct and separate
10 regions. A first region is defined by the bore of
11 the conduit 32'' and the part of the production wing
12 bore 14 beneath the choke body 12 leading to the
13 outlet 18. The second region is defined by the
14 annulus between the conduit 32'' and the housing
15 20''/the choke body 12. Thus, the conduit 32''
16 forms the boundary between these two regions, and
17 the seal 36 ensures that there is no fluid
18 communication between these two regions, so that
19 they are completely separate.

20
21 In use, the embodiments of Figs 2 and 3 function in
22 substantially the same way. The valves V1 and V2
23 are closed to allow the choke to be removed from the
24 choke body 12 and the diverter assembly 10', 10'' to
25 be clamped on to the choke body 12, as described
26 above with reference to Fig 1. Further pipework
27 leading to desired equipment is then attached to the
28 aperture 30', 30''. The diverter assembly 10', 10''
29 can then be used to divert fluids in either
30 direction therethrough between the apertures 18 and
31 30', 30''. In the Fig 2 embodiment, there is the
32 option to divert fluids into or from the well, if

17

1 the valves V1, V2 are open, and the option to
2 exclude these fluids by closing at least one of
3 these valves. In the Fig 3 embodiment, no fluids
4 can enter or leave the well, due to the seal 36;
5 this embodiment can only be used to divert fluids up
6 or down the conduit 32''. The Fig 3 embodiment
7 provides the additional security of a third barrier
8 formed by the seal 36, against any fluids leaking
9 out of the well. The Fig 2 embodiment can be used
10 to recover fluids from or inject fluids into a well.
11 The Fig 2 and Fig 3 embodiments may equally be
12 clamped to an annulus choke body of an annulus wing
13 branch leading to an annulus bore of a well, rather
14 than the production choke body and production wing
15 branch illustrated here.

16
17 Fig 4 shows a further embodiment of a diverter
18 assembly which is similar to the Fig 3 embodiment,
19 and like parts are designated with like reference
20 numbers having a triple prime. The difference from
21 the Fig 3 embodiment is that the annulus 34'''
22 between the conduit 32''' and the housing 20''' is
23 open at its upper end, leading to an aperture 38'''
24 in the side wall of the housing 20'''. This
25 embodiment provides a first flow region defined by
26 the bore of the conduit 32''' and a second flow
27 region defined by the annulus 34'''. Since the
28 annulus 34''' is in communication with the wing
29 branch and the aperture 38''', fluids can also flow
30 in the second flow region. As the first and second
31 regions are separated from each other by the conduit
32 32''', simultaneous flow in the first and second

1 flow regions may take place. The flow may be in the
2 same direction, or different directions.
3

4 Optionally, the apertures 30''' and 38''' may be
5 connected by pipework (not shown) so that fluids may
6 flow through one of the flow regions, through the
7 pipework, and then through the other of the flow
8 regions. Flow could take place in either direction,
9 depending on whether recovery or injection of fluids
10 is required. Optionally, the fluids could pass via
11 a processing apparatus located in the pipework
12 connecting the first and the second flow regions.
13 Optionally, only a proportion or a component of the
14 fluids could be returned to the other of the first
15 and the second flow regions after processing to
16 remove the rest of the fluids. For example,
17 produced fluids (a combination of hydrocarbons,
18 water and sand) could be recovered from a well via
19 the annulus 34'', processed to separate the
20 hydrocarbons from the water and sand, and only the
21 hydrocarbons could be returned to the bore of the
22 conduit 32''' for recovery. To inject fluids, the
23 flow direction could be reversed.
24

25 Thus, the invention provides a means for diverting
26 the fluids from a first portion of a first flowpath
27 (e.g. the annulus 34'') to a second flowpath (e.g.
28 the pipework connecting the aperture 38''' to the
29 aperture 30'') and a means for diverting the fluids
30 from the second flowpath to a second portion of the
31 first flowpath (e.g. the bore of the conduit 32''').
32

1 These embodiments have the advantage of providing a
2 safe way to connect further pipework to the well,
3 without having to disconnect any of the existing
4 pipework, and without a significant risk of fluids
5 leaking from the well into the ocean.

6
7 Modifications and improvements may be incorporated
8 without departing from the scope of the invention.
9 For example, as stated above, the diverter assembly
10 could be attached to an annulus choke body, instead
11 of to a production choke body.

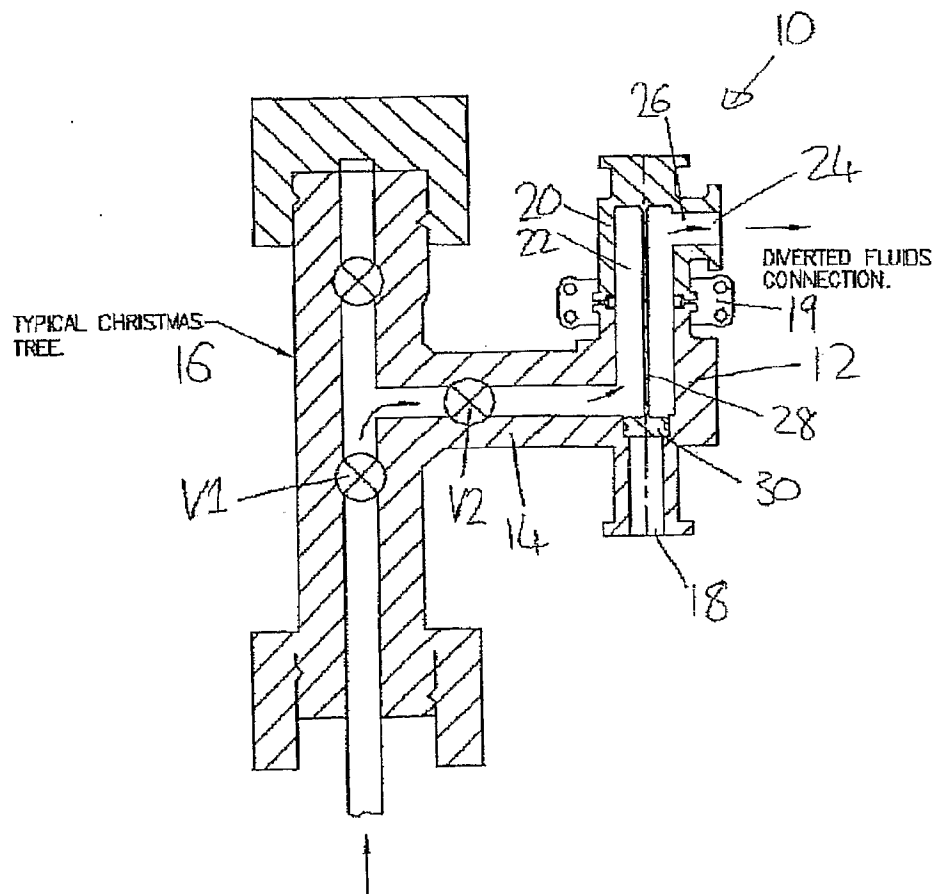
12
13 The uses of the invention are very wide ranging.
14 The further pipework attached to the flow diverter
15 assembly could lead to an outlet header, an inlet
16 header, a further well, or some processing apparatus
17 (not shown). The processing apparatus itself could
18 be one or more of a wide variety of equipment. For
19 example, the processing apparatus could comprise a
20 pump or process fluid turbine, for boosting the
21 pressure of the fluid. Alternatively, or
22 additionally, the processing apparatus could inject
23 gas or steam into the well fluids. The injection of
24 gas could be advantageous, as it would give the
25 fluids "lift", making them easier to pump. The
26 addition of steam has the effect of adding energy to
27 the fluids.

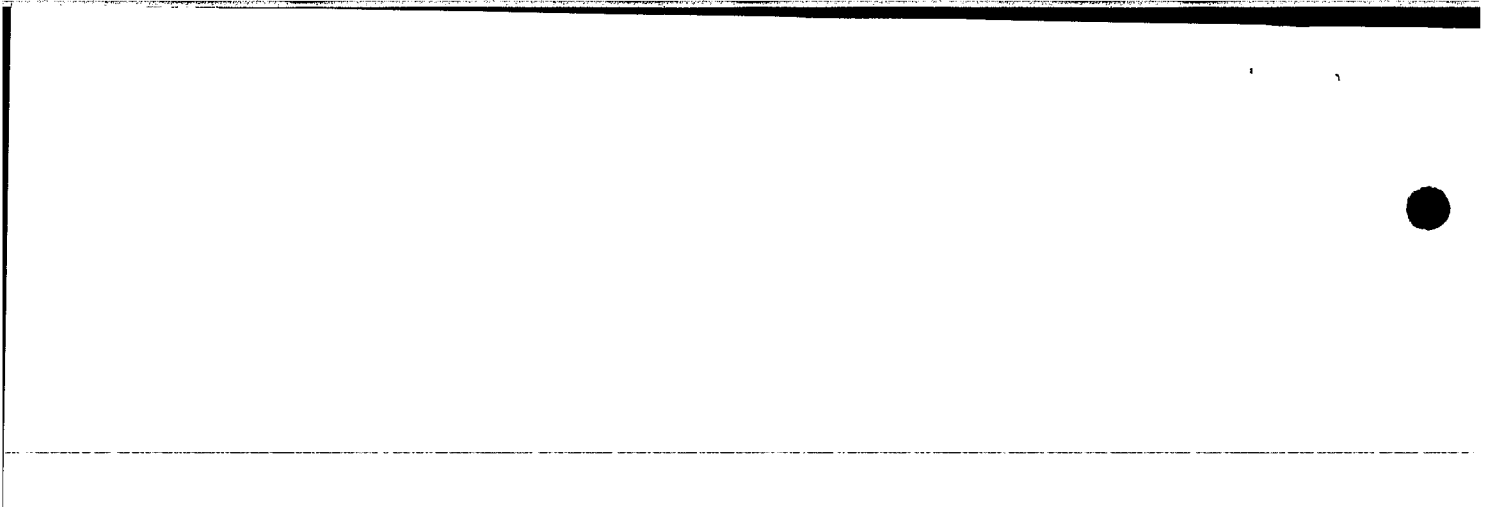
28
29 The processing apparatus could also enable chemicals
30 to be added to the well fluids, e.g. viscosity
31 moderators, which thin out the produced fluids,
32 making them easier to pump, or pipe skin friction

1 moderators, which minimise the friction between the
2 fluids and the pipes. The chemicals/ injected
3 materials could be added via one or more additional
4 input conduits. The processing apparatus could also
5 comprise a fluid riser, which could provide an
6 alternative route to the surface for the produced
7 fluids. The processing equipment could
8 alternatively or additionally include measurement
9 apparatus, e.g. for measuring the temperature/flow
10 rate/constitution/ consistency, etc. The separation
11 equipment may be adapted to separated gas, water,
12 sand/debris and/or hydrocarbons.
13
14 Many of these processes may never have been
15 envisaged when the christmas tree was originally
16 installed, and the invention provides the advantage
17 of being able to adapt these existing trees in a low
18 cost way without risking leaks.
19

MARS CHOKE INSERT WELL FLUID DIVERTER.

Fig 1





MARS CHOKE FLOWLINE FLUID DIVERTER.

Fig 2

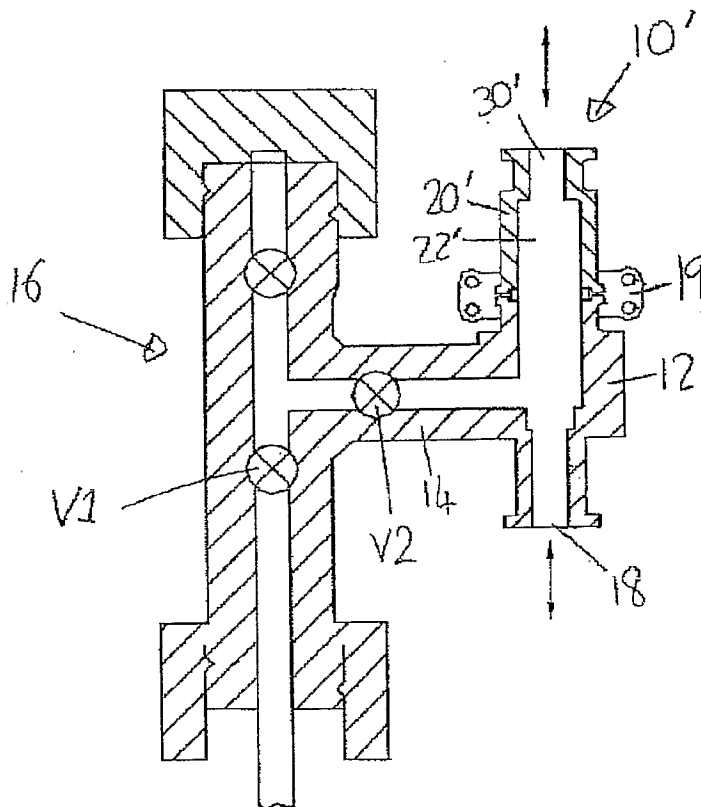
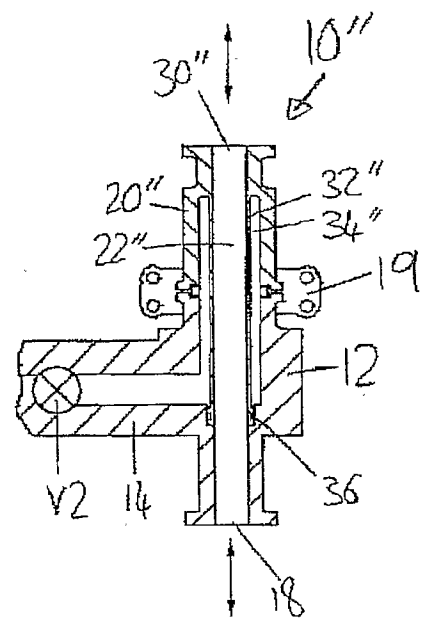


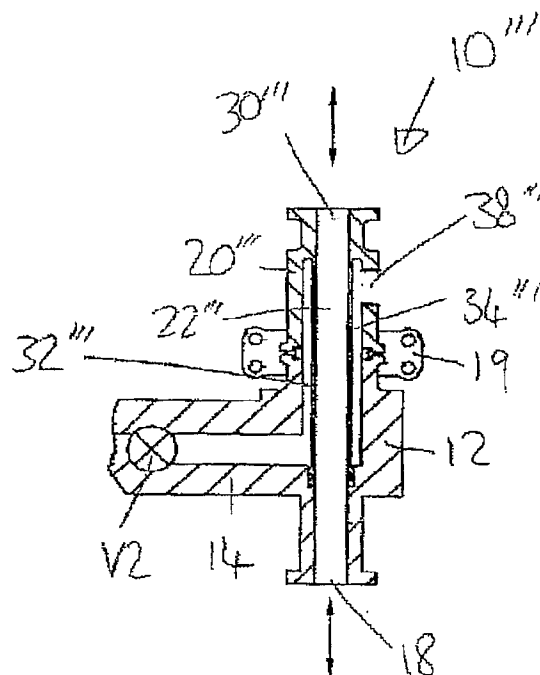
Fig 3





MARS CHOKE FLOWLINE FLUID DIVERTER.

Fig 4



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